EM-247C DC-MOTOR STARTER and CONTROLLER 12-36V 70A

FEATURES

- recommended motor max.
  12V 0.7kW and 24V 1kW
- current (torque) limit
- starter or speed control mode
- flexible control inputs
- brake res. output
- impulse / continuous mode
- rail base mountable
- digital parameter setting

APPLICATIONS

- DC motor soft start
- DC motor speed control
- DC motor direction change
- small vehicles
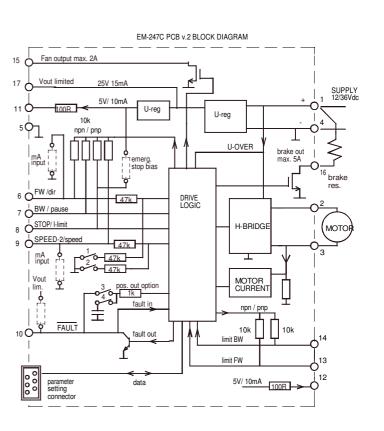- lifters and conveyor
- actuators torque limit

EM-247C is a full bridge DC-motor starter. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor shut-down but there are also available individual limit inputs for FW and BW directions. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.
There are 2 selectable control modes, contionuous and impulse. In continuous mode the motor runs as long as the control is active.
In impulse mode a short comand starts the motor, and only a new impulse will change the status. The card has selectable input logics.
Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic. The parameters are set with EM-236 interface unit. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.
In C-version program is possible to select 16kHz pwm frequency (= silent) but notice that current output capability is lower with 16kHz.

TECHNICAL DATA

Supply voltage nominal 12-36V, limits 10-45V
Start up voltage 9V, shutdown voltage 8V
Idle current typ 15mA
Motor current max. with 2kHz pwm
100% pwm 75A , 20-99pwm% 45A and peak 100A (5s)
Motor current max. with 16kHz pwm
100% pwm 60A , 20-99pwm% 35A and peak 70A (5s)
NOTICE continuous high current use the fan could be needed.
Current limit adjustable 1-100A
NOTICE ! during start ramp the current limit is 50% boosted
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz or 16kHz
Speed input range (pin 9) 0-1...5 or 0- 2...10V= 0-100% pwm
 this range can be adjust with parameter 4
I-limit input scale (stop input) 0-4V = 0-160A
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max. 40V / 1A
Fault in actives Uin < 1V (NPN)
Fan-output switch on 55°C, off 50°C
Fan-output NPN max. 40V 2A
Break load output Max. 40V 7A
Vout lim output   max 25V 15mA
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 107x73x40mm
Dimensions in DIN-rail base 110x80x55mm
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60°C
Weight 200g

EM-247C PCB v.2 BLOCK DIAGRAM

ELECTROMEN Oy

www.electromen.com

CONNECTIONS

Supply voltage recomendation is 12-36VDC
and ripple should be less than 20% at full load.
Supply voltage limit is 45Vdc
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

1/5 Motor current 0-100A (0-100)
2/5 PWM-level-% 0-100% (0-100)
3/5 hour counter (max.65535h)
4/5 start counter (max.65535)
5/5 carry counter for start counter

FAULT-LED signal codes

1. power on   one blink
2. current on limit   led is lit
3. current trip   fast blinking...
4. zero-cur trip   long blink- short pause...
5. overvoltage   4 x blink -pause...
6. overheat   short blink- long pause...
7. timeout   3 x blink + long blink...
8. fault input   2 x short + 1x long blink...

ADJUSTMENT AND SETTINGS (prog. EM-247C v.2.0)

Settings can be done with 3 interface device options.
1. EM-236 interface unit
2. EM-268 or 328 interface units with EmenTool Lite PC-software
3. EM-326 interface unit with EmenTool App smartphone application.
  If using App you can set device-specific access code, which protects device
  against unauthorized smartphone connections. The access code can be reset
  with simultaneous FW and BW comand, when power switch on.

DIP SWITCHES

Dip-1 input range (pin6) 0-5V=off / 0-10V=on (in analog speed modes)
Dip-2 input range (pin9) 0-5V=off / 0-10V=on (in analog speed modes)
Dip-3 position output option, keep OFF
Dip-4 position output option, keep OFF

Limit inputs FW / BW

These inputs stop motor without ramp with dynamic brake
But in control mode "2-speed" dynamic brake is enabled
only when speed-2 is activated.
If motor has stopped with limit switch the dynamic brake is
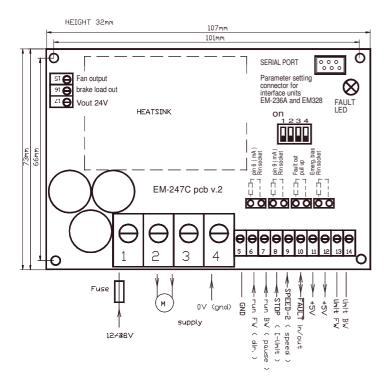at least 1s. active, also in case when freewheel is selected.

FAULT in/out

This NPN input pull down when fault. Combination can be
selected with parameter 10.
If this input is pulled down with externally, then it would
disabled motor as long as pulled down.

SPEED-2 input

This input activates speed-2 when 2-speed mode is selected
In analog speed modes this input work as speed set input

SERIAL PORT (red micromatch connector)

This is normally for parameter settings and monitoring with
Ementool program or EM-interface units.
But there is also availability for open protol control (Modbus)
This option has own instruction guide.

SETTABLE PARAMETERS
prog. 247C v2.0 (defaults in brackets)

1 command mode: (0)
  continuous = 0,
  impulse = 1 direction change with stop
  impulse 2 = 2 dir. change without stop
2 start condition combinations: 0-3   (1)
  0= start both direction after I-trip and Stop
  1= start only opposite direction after I-trip
  2= start only opposite direction after Stop
  3= start only opposite direction after I- and Stop
3 input logic combinations 0-7 PNP/NPN (0)
  PNP control with positive signal and input has pull down res.
  NPN control with negative signal and input has pull up res.
  N.C. = input resistor as above, but control signal logic is inverted
  0= cont. PNP, limits PNP   4=cont. PNP, limits PNP N.C.
  1= cont. NPN, limits PNP   5=cont. NPN, limits PNP N.C.
  2= cont. PNP, limits NPN N.C. 6=cont. PNP, limits NPN
  3= cont. NPN, limits NPN N.C. 7=cont. NPN, limits NPN
4 running speed-1: 0-100% / 0-100   (100)
  If analog speed input mode is select with parameter 5,
  then parameter 4 work analog input range adjust
5 control mode / running speed-2 preset 0-100% / 0-100   (50)
  0= Analog speed mode -1
     "speed 2-input" is used as analog 0-5V speed control input.
  1= Analog speed mode -2
     as above but FW direction is automatically "on" and
     FW input works as direction change input.
     BW input works as pause input
  2-100 = 2-speed mode (two digitally settable speed)
     speed-1 preset with param. 4 and speed-2 with param. 5)
**6 current limit FW: 1-100A / 1-100   (10)
**7 current limit REV: 1-100A / 1-100   (10)
  NOTICE ! If both 6 & 7 is set = 0, then I-limit input is enabled,
  and stop input works as current limit adjust input. (0-5V)
8 Trip combinations: 0-3 (1)
  0= no I-trip, no zero-current-trip
  1= only I-trip
  2= only zero-current-trip
  3= both I-trip and zero-current-trip
9 I-trip delay: 0-255ms / 0-255 (20)

10 Fault output combinations: 0-3 (1)
  0= I-trip and zero current won´t cause fault output signal
  1= only I-trip causes fault output signal
  2= only zero current causes fault output signal
  3= both I-trip and zero current causes fault output signal.
  4= overcurrent indication = pull down
  5= "run" indication = pull down when motor run
11 overvoltage limit: 15-60V / 15-60 (35) DO NOT SET > 45 !
  Overvoltage can be caused when slowing down or
  external force rotates motor, then voltage rises result of
  regenerating energy. Exceeding the limit will cause first
  the brake output activation, then the limit+1V the power
  stage releases to freewheel, and last the limit+3V the
  power stage starts dynamic braking.
12 load compensation: 0-255 / 0-255 (0)
  Load compensation (RxI) improves low speed and start
  torgue, but too high compensation achieve unstable running.
  Run motor at low speed (30%) Increace compensation
  with small steps until motor start behaviour unstable,
  then decrease value about 10%
13 timeout: 0-255s. / 0-255 (0=not in use)   (0)
14 reset for start and hour-counter 0/1   (0)
  selecting 1 and push save = reset counters
15 start ramp: 0-5s / 0-500 (100)
16 stop ramp: 0-5s / 0-500 (100)
17 start kick 0-200ms / 0-200 (0)
  gives short 0-200ms full drive pulse for start
18- I-trip auto reversing 0-5s / 0-500 (0)
  Change automatically run direction when I-trip occurs
  the revesing time will select with this parameter
19- Freewheel options 0-5 (0)
  0= freewheeling when overvoltage
  1= freewheeling when overv. or stopped
  2= freewheeling when overv. or during stop ramp
  3= freewheeling when overv. or when stopped or during stop ramp
20- Pwm frequency 1=2kHz / 2=16kHz (1)

21- Pin-16 (brake load) options 0-2 (0)
  0= regen. braking = switch on when overvoltage exceed
  1= running indication = switch on pin-16 when motor run
  2 =as above but also stop input switch on pin-16
22 Serial line configuration, speed, parity, and number of stop bits (1)
  1 =9600bps 8N1   5 =19200bps 8N1
  2 =9600bps 8N2   6 =19200bps 8N2
  3 =9600bps 8E1   7 =19200bps 8E1
  4 =9600bps 8O1   8 =19200bps 8O1
23 Modbus address 1-247 (1)

    Optional resistor :
    1. pin 6 input 250ohm resistor if want to
       use mA input signal (only if -SAF firmware)
    2. pin 9 input 250ohm resistor if want to
       use 0-20mA speed set signal
    3. Fault output 2.2kohm res for pull up
       if want to connect for PNP input of PLC
    4. Emerg. bias resistor for stop input
       for stop input line monitoring in safety
       switch installation (need special software)

    The special input functions below will be activate
    with parameters. In drawing these inputs are in brackets.

    *Analog speed mode-1, pin9=speed set.
    *Analog speed mode-2 pin9=speed set, 6=direction, 7=pause

    **Analog I -lim input is activated with set param. 6&7= 0

HEIGHT 32mm   107mm
                     101mm

15 Fan output
16 brake load out
17 Vout 24V

HEATSINK

SERIAL PORT
Parameter setting
connector for interface units
EM-236A and EM328

FAULT
LED

on
1 2 3 4

73mm 66mm

EM-247C pcb v.2

pin 6 (mA) Rin socket
pin 9 (mA) Rin socket
Fault out pull up
Emerg. bias Rin socket

1 2 3 4   5 6 7 8 9 10 11 12 13 14

Fuse

M

0V (gnd)

supply

12-36V

GND
run FW (dir.)
run BW (pause)
STOP (I-limit)
SPEED-2 (speed)
FAULT in/out
+5V
+5V
Limit BW
Limit FW